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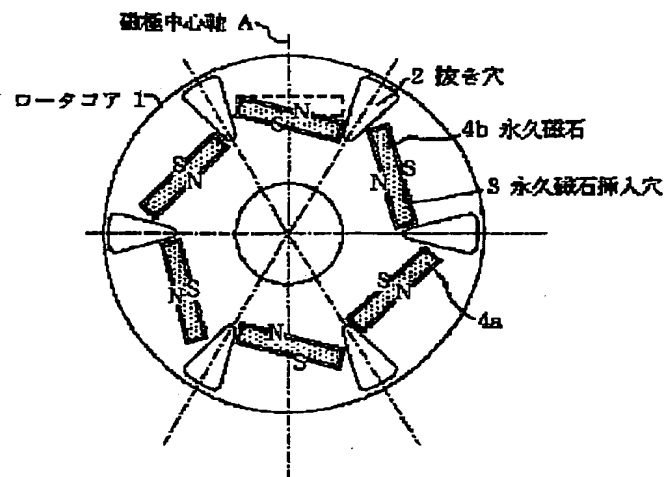
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APPLICANT : YASKAWA ELECTRIC CORP;

INVENTOR : IWABUCHI KENSHO;

INT.CL. : H02K 1/27

TITLE : ROTOR FOR PERMANENT MAGNET
SYNCHRONOUS ELECTRIC
ROTATING MACHINE



ABSTRACT : PURPOSE: To obtain a rotor for a permanent magnet synchronous electric machine, especially a rotor suitable in one direction rotation, in which the total amount of flux is increased while enhancing the strength and facilitating the manufacture.

CONSTITUTION: In the rotor for a permanent magnet synchronous electric rotating machine where a permanent magnet 4b is embedded in a rotor core 1 comprising a laminate of thin disc-like electromagnetic steel plates, a hole 2 for preventing leakage flux is punched between respective electrodes of the rotor core 1. A rectangular hole 3 is then made between the holes 2 while inclining at a predetermined angle with respect to the circumferential direction and a magnetized permanent magnet 4b is inserted therein.

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CLAIMS

[Claim(s)]

[Claim 1]In a rotor of a permanent magnet form synchronous dynamo-electric machine which lays underground a permanent magnet which becomes an inside of a rotor core which laminated a disc-like magnetic steel sheet of thin meat with a field, A rotor of a permanent magnet form synchronous dynamo-electric machine having extracted for leakage flux prevention, having provided a hole, having extracted for this leakage flux prevention, having provided a rectangular permanent magnet insertion hole with a predetermined angle of inclination to a circumferencial direction between holes, and inserting a permanent magnet in this permanent magnet insertion hole between each pole of said rotor core.

[Claim 2]A rotor of the permanent magnet form synchronous dynamo-electric machine according to claim 1 which provided said permanent magnet insertion hole for every pole in even pitch, replaced the polarity of a diameter direction by turns, and inserted a permanent magnet.

[Claim 3]A rotor of the permanent magnet form synchronous dynamo-electric machine according to claim 1 which inserted a magnetic belt bar in a permanent magnet insertion hole in which every other pole of said permanent magnet insertion hole inserts a permanent magnet which made polarity the same to a diameter direction, and which is not inserting a permanent magnet.

[Claim 4]A rotor of the permanent magnet form synchronous dynamo-electric machine according to claim 1 which provided said permanent magnet insertion hole in even pitch in every other pole, and inserted in this permanent magnet insertion hole a permanent magnet which made polarity of a diameter direction the same.

[Claim 5]A rotor of the permanent magnet form synchronous dynamo-electric machine according to claim 3 which it extracted for said leakage flux prevention, and made a hole two kinds which differ in the depth.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Industrial Application]This invention relates to the rotor which was suitable for one-way rotation especially about the rotor structure of the permanent magnet form synchronous dynamo-electric machine which carries out the inner package of the permanent magnet to a rotor core.

[Description of the Prior Art]The sheet metal which carried out the segment to the approximately sector which made the side incline to a normal line direction as a conventional permanent magnet form synchronous dynamo-electric machine is laminated, a rotor yoke and a rectangular permanent magnet are arranged by turns to a circumferencial direction, and there are some which increase the amount of total magnetic flux (for example, JP,4-312334,A).

[Problem(s) to be Solved by the Invention]However, there were the following problems in conventional technology.

1) Since the segment of the rotor yoke is carried out, it is necessary to unify the rotor yokes of each with a tie rod and an end plate.

2) In order for the magnetic flux which a permanent magnet makes to make it not leak to a shaft, a nonmagnetic material needs to perform magnetic shielding for between shafts the rotor yoke inside diameter side.

That is, if this composition is taken, intensity will have a difficulty and structure will become complicated. Then, this invention increases the amount of total magnetic flux of a permanent magnet, its intensity is high and an object of this invention is to provide the rotor of the permanent magnet form synchronous dynamo-electric machine which is easy to manufacture.

[Means for Solving the Problem]In a rotor of a permanent magnet form synchronous dynamo-electric machine which lays underground a permanent magnet which becomes an inside of a rotor core in which this invention laminated a disc-like magnetic steel sheet of thin meat with a field in order to solve the above-mentioned problem, Between each pole of said rotor core, it extracts for leakage flux prevention, a hole is provided, and it extracts for this leakage flux prevention, and between holes, a rectangular permanent magnet insertion hole is aslant given with a predetermined angle of inclination to a circumferencial direction, and a permanent magnet magnetized to this is inserted.

[Function]While the amount of total magnetic flux increases by having provided the permanent magnet aslant with the predetermined angle of inclination by the above-mentioned means, directivity appears in reluctance. A rotor and a permanent magnet are unified.

[Example]Hereafter, it explains based on the first example of this invention. Drawing 1 is 6 pole motor.

It is an example which constitutes six poles from six permanent magnets.

The rotor core 1 which laminated the sheet metal of the ferromagnetic is equally divided into six by 60 degrees of mechanical angles in a normal line direction, and on the bisectrix, it extracts for leakage flux prevention of a reverse sector, and the hole 2 is given six places so that the inside diameter side may be on the inside diameter side rather than the end of the direction near the inside diameter of the below-mentioned permanent magnet insertion hole 3. Extract, extract to this case (a dotted line shows) where made the pole center axis A and the permanent magnet insertion hole 3 cross at right angles, and it is provided between the holes 2, leave the one end by the side of the hole 2 as it is, and it is made to incline to the pole center axis A, and six places are provided so that a slope direction may become the same over the perimeter. At this time, a motor rotation direction turns into a direction in which the inclination fell. The directions of the magnetization of the isomorphism-like permanent magnets 4a and 4b to this permanent magnet insertion hole 3 are N and S..... Burial immobilization is carried out so that it may become by turns. The permanent magnet 4 inserted in the permanent magnet insertion hole 3 so that the polarity of a diameter direction may become the same, It inserts every 1 pole pitch, the magnetic body bar in which amplitude permeability is the same as that of the rotor core 1, or differs is inserted in the permanent magnet insertion hole 3 without a permanent magnet, and it may be made to adjust the difference of a place with the permanent magnet 4, and the permeance which is not. Drawing 2 is a motor of six poles in

which other examples are shown. This example is an example which constitutes six poles from 4 or 3 permanent magnet magnets. The rotor core 1 is equally divided into six by 60 degrees of mechanical angles in a normal line direction, on the bisectrix, it extracts for leakage flux prevention of the reverse sector from which the depth is different, and the hole 2a and 2b are given by turns. this – it extracts, and between the hole 2a and 2b, alternately (120-degree pitch), it is made to incline like an example and the permanent magnet insertion hole 3 is formed. However, the permanent magnet insertion hole 3 is made to have inclined with the example, so that the shallower one may extract, the inside diameter side of the hole 2a and the deeper one may extract and it may be on an outer diameter side rather than the inside diameter of hole 2b. It inserts and the permanent magnet 4 which magnetized the permanent magnet 4 in N and the S either 1 direction is fixed to this permanent magnet insertion hole 3 so that all the polarity of a diameter direction may become a uniform direction. In other examples, there keeps being no ***** the permanent magnet insertion hole 3, and The hole 2a, The rotor core part between 2bs is made to intersect perpendicularly or incline with a normal line direction, the permanent magnet insertion hole 3 and the same insertion aperture are provided, the magnetic belt bar in which magnetic permeability is the same as the rotor core 1, or differs from each other is inserted, and it may be made to adjust the difference of a place with the permanent magnet 4, and the permeance which is not.

[Effect of the Invention]As more than stated, according to this invention, there are the following effects.

(1) Reluctance torque can be increased because the amount of total magnetic flux performs phase control of increase and current by inserting a permanent magnet in the permanent magnet insertion hole which gave and provided the predetermined inclination between the magnetic poles of a rotor core. When directivity arises in reluctance and the hand of cut is both decided, starting and gear change become easy.

(2) About a rotor core, since the disk of one sheet is laminated, intensity and accuracy improve and manufacture also becomes easy without manufacture of an induction motor and great difference.

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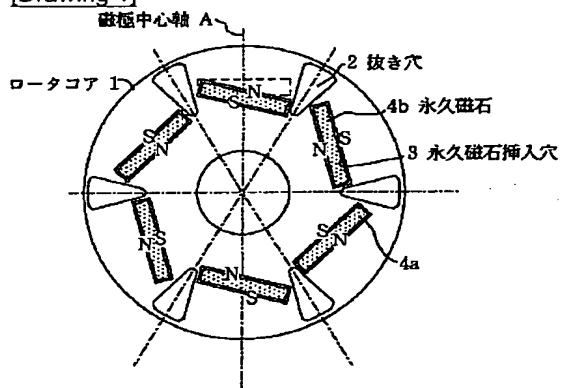
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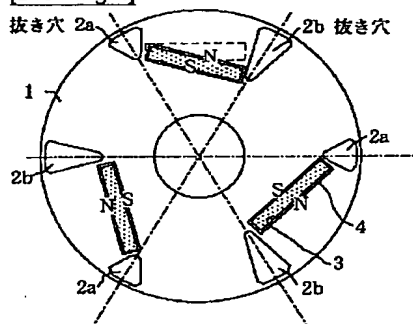
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]

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(71)出願人 000006622

株式会社安川電機

福岡県北九州市八幡西区黒崎城石2番1号

(72)発明者 宮本 恭祐

福岡県北九州市八幡西区黒崎城石2番1号

株式会社安川電機内

(72)発明者 石川 浩二

福岡県北九州市八幡西区黒崎城石2番1号

株式会社安川電機内

(72)発明者 岩淵 憲昭

福岡県北九州市八幡西区黒崎城石2番1号

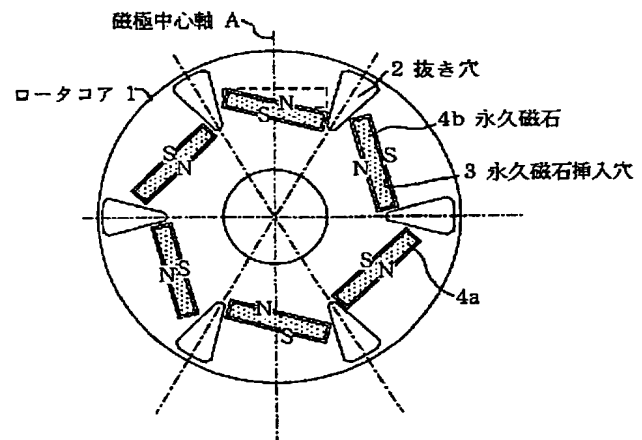
株式会社安川電機内

(54)【発明の名称】 永久磁石形同期回転電機のロータ

(57)【要約】

【目的】本発明は、永久磁石形同期回転電機のロータに関し、特に、一方向回転に適したロータに関し、総磁束量を増大させ、強度を向上し、製作し易いロータを実現することを目的とする。

【構成】薄肉の円盤状の電磁鋼板を積層したロータコア1の内部に、界磁となる永久磁石4を埋設する永久磁石形同期回転電機のロータにおいて、前記ロータコア1の各極間に、漏れ磁束防止用の抜き穴2を設け、この漏れ磁束防止用の抜き穴2間に、長方形の永久磁石挿入穴3を円周方向に対し所定の傾斜角で斜めに施し、これに着磁した永久磁石4を挿入する。



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【特許請求の範囲】

【請求項 1】 薄肉の円盤状の電磁鋼板を積層したロータコアの内部に、界磁となる永久磁石を埋設する永久磁石形同期回転電機のロータにおいて、

前記ロータコアの各極の間に、漏れ磁束防止用の抜き穴を設け、この漏れ磁束防止用の抜き穴間に、長方形の永久磁石挿入穴を円周方向に対し所定の傾斜角で設け、この永久磁石挿入穴に永久磁石を挿入したことを特徴とする永久磁石形同期回転電機のロータ。

【請求項 2】 前記永久磁石挿入穴を等ピッチで各極ごとに設け、径方向の極性を交互に入れ換えて永久磁石を挿入した請求項 1 記載の永久磁石形同期回転電機のロータ。

【請求項 3】 前記永久磁石挿入穴の 1 極置きに、極性を径方向に同一にした永久磁石を挿入し、永久磁石を挿入していない永久磁石挿入穴に磁性帯バーを挿入した請求項 1 記載の永久磁石形同期回転電機のロータ。

【請求項 4】 前記永久磁石挿入穴を等ピッチで 1 極置きに設け、この永久磁石挿入穴に径方向の極性を同一にした永久磁石を挿入した請求項 1 記載の永久磁石形同期回転電機のロータ。

【請求項 5】 前記漏れ磁束防止用の抜き穴を深さが異なる 2 種類とした請求項 3 記載の永久磁石形同期回転電機のロータ。

【発明の詳細な説明】

【産業上の利用分野】 本発明は、永久磁石をロータコアに内装する永久磁石形同期回転電機のロータ構造に関し、特に、一方向回転に適したロータに関する。

【従来の技術】 従来の永久磁石形同期回転電機として、側面を法線方向に対し傾斜させた略扇形にセグメントした薄板を積層しロータヨークと矩形の永久磁石を円周方向に交互に配置し、総磁束量を増大させるものがある（例えば、特開平 4-312334 号公報）。

【発明が解決しようとする問題点】 ところが、従来技術では、以下のような問題点があった。

1) ロータヨークをセグメントしているため、ロータヨークのおのおのをタイロッドと端板によって一体化する必要がある。

2) 永久磁石の作る磁束がシャフトに漏れなくするため、ロータヨーク内径側とシャフトとの間を、非磁性体により磁気遮蔽を行う必要がある。

すなわち、この構成を取ると、強度に難点があり、構造が複雑になる。そこで、本発明は、永久磁石の総磁束量を増大させ、強度が高く、製作し易い永久磁石形同期回転電機のロータを提供することを目的とする。

【課題を解決するための手段】 上記問題を解決するために、本発明は、薄肉の円盤状の電磁鋼板を積層したロータコアの内部に、界磁となる永久磁石を埋設する永久磁石形同期回転電機のロータにおいて、前記ロータコアの各極間に、漏れ磁束防止用の抜き穴を設け、この漏れ磁

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束防止用の抜き穴間に、長方形の永久磁石挿入穴を円周方向に対し所定の傾斜角で斜めに施し、これに着磁した永久磁石を挿入する。

【作用】 上記手段により、永久磁石を所定の傾斜角で斜めに設けたことにより総磁束量が増大するとともに、リラクタンスに方向性が出る。ロータと永久磁石が一体化される。

【実施例】 以下、本発明の第一の実施例に基づいて説明する。図 1 は、6 極モータであり、永久磁石 6 個で 6 極を構成する例である。強磁性体の薄板を積層したロータコア 1 を機械角 60° で法線方向に 6 等分し、その等分線上には、逆扇形の漏れ磁束防止用の抜き穴 2 を、その内径側が後述の永久磁石挿入穴 3 の内径に近い方の端部よりもその内径側になるように、6 力所施す。この抜き穴 2 間に、永久磁石挿入穴 3 を、磁極中心軸 A に直交させて設けた場合（点線で示す）に対し、抜き穴 2 側の一方端をそのままにし、磁極中心軸 A に対し傾斜させて、全周にわたり傾斜方向が同一になるように 6 力所設ける。この時、モータの回転方向は、傾斜が下がった方向となる。この永久磁石挿入穴 3 に同形状の永久磁石 4 a、4 b を着磁の方向が N、S……交互になるように埋設固定する。なお、永久磁石挿入穴 3 に挿入する永久磁石 4 を、径方向の極性が同一になるように、1 極ピッチ置きに挿入し、永久磁石のない永久磁石挿入穴 3 に透磁率がロータコア 1 と同一もしくは異なる磁性体バーを挿入して、永久磁石 4 のあるところとないところのパーミアンスの差を調整するようにしてもよい。図 2 は、他の実施例を示す 6 極のモータである。この例は、永久磁石 4、3 個で 6 極を構成する例である。ロータコア 1 を機械角 60° で法線方向に 6 等分し、その等分線上には、深さが違う逆扇形の漏れ磁束防止用の抜き穴 2 a、2 b が交互に施されている。この抜き穴 2 a、2 b 間には 1 つ置き（ 120° ピッチ）に、実施例と同様に傾斜させて、永久磁石挿入穴 3 を設ける。ただし、実施例とは、永久磁石挿入穴 3 は、浅い方の抜き穴 2 a の内径側と深い方の抜き穴 2 b の内径よりも外径側になるように、傾斜させてある。この永久磁石挿入穴 3 に、永久磁石 4 を、N、S どちらか 1 方向に着磁した永久磁石 4 を、径方向の極性が全て同一方向になるように挿入し固定する。なお、他の実施例において、永久磁石挿入穴 3 を設けていない抜き穴 2 a、2 b 間のロータコア部に、法線方向と直交もしくは傾斜させて永久磁石挿入穴 3 と同様な挿入穴を設け、ロータコア 1 と透磁が同じもしくは異なる磁性体バーを挿入し、永久磁石 4 のあるところとないところのパーミアンスの差を調整するようにしてもよい。

【発明の効果】 以上の述べたように、本発明によれば以下のような効果がある。

(1) ロータコアの磁極間に、所定の傾斜を持たせて設けた永久磁石挿入穴に、永久磁石を挿入することで、総

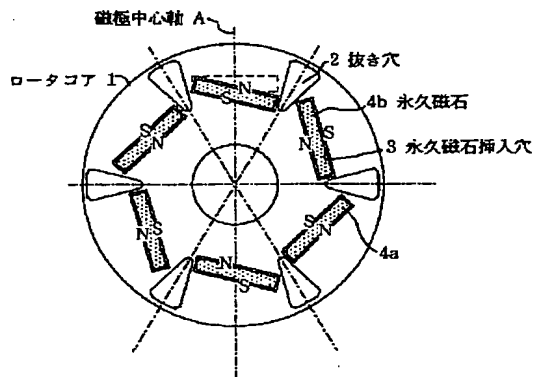
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磁束量が増し、電流の位相制御を行うことでリラクタンストルクを増大できる。とともに、リラクタンスに方向性が生じ、回転方向が決まっている場合は、起動・変速が楽になる。

(2) ロータコアを一枚の円板を積層してあるので、強度と精度が向上し、製作も、誘導電動機の製作と大差無く楽になる。

【図面の簡単な説明】

【図1】



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【図1】本発明の実施例を示す断面図

【図2】本発明の他の実施例を示す断面図

【符号の説明】

- 1 ロータコア
- 2、2 a、2 b 抜き穴
- 3 永久磁石挿入穴
- 4、4 a、4 b 永久磁石

【図2】

